Background Discussion Document On Energy In New Brunswick (1990-2000)

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Synopsis

Energy development and the rate of consumption have played key roles in maintaining and enhancing the quality of life in New Brunswick. As the Province enters the decade of the 1990's it is faced with a need to develop an energy policy which continues to recognize the integral role energy security and supply play in economic development by creating jobs and providing incentives through secure, reasonably priced energy supplies. At the same time any policy must address the impacts that energy supply and demand place on the environment.

Historically, energy policy has been supply oriented, driven by energy prices and security of supply. Today the focus is the challenge of sustainable development. Global concern over atmospheric emissions, particularly greenhouse gases derived from fossil fuels, has placed energy and the environment high on the agenda of all levels of government. The growing scientific evidence relating to atmospheric emissions from energy sources and use requires changes which will impact on the lives of all citizens.

New Brunswick has only limited indigenous resources such as wood, coal, and hydro, with some geological potential for oil, gas, and oil shale. Consequently, the province must rely on external supplies such as offshore oil, coal, and uranium to meet its energy demand. Canadian oil and natural gas remains inaccessible to New Brunswick as both transportation pipelines stop in Quebec and east coast production has yet to commence. Electricity is presently generated from hydro, indigenous coal, imported oil and nuclear with a small amount from wood at a number of pulp mills using cogeneration. Electricity supply is also supplemented through interconnections with neighbouring provincial and U.S. utilities.

Energy efficiency is recognized as an environmentally benign "source" of energy and in fact makes economic sense in itself. Subsequent to the rapid escalation of oil prices in the seventies, all sectors of the provincial economy achieved energy savings. Governments now seriously consider energy efficiency not as simply "conservation" whereby society must do without, but rather the provision of the same or better services using less energy. It is a demand-side option which offers considerable environmental and economic benefits to all sectors of the economy.

In developing an energy policy for the next decade and beyond it is important to consider existing energy supply and demand. In 1988 New Brunswick energy consumption by primary energy sources showed oil to be dominant at 66%; wood 22%; nuclear 5%; coal 4%; and hydro 3%. Consumption by sector in the same year showed: industrial 47%; transportation 24%; residential 18%; and commercial/institutional 11%. Electricity as a secondary source has been the dominant energy form since the rapid oil price escalation in 1979 and government "off-oil" policies. Electricity developments and use have offered several advantages through domestic consumption and export sales.

Certain sectors, such as transportation, have only limited fuel choices in New Brunswick. Industrial and residential use of wood constituted 22% of primary energy in 1988, a fact which is little recognized by many. Electricity by end use is considered a "clean fuel" but this neglects consideration of the type of power generation. Thus no one source or use of energy is without some economic, social or environmental impact.

A balanced approach to energy policy takes into consideration both supply and demand options. It considers the benefits that accrue to the province through energy developments such as electric power generation and sales, industrial competitiveness, and economic development. At the same time it needs to be balanced with demand-side options of energy efficiency and conservation actions in all sectors of the provincial economy. This reduces energy demand and consequently the need for new supplies.

The Province needs to complete a study of total energy demand in order to obtain a clear picture of the future demand by all energy sectors. Of equal importance is the need for a detailed analysis of the major energy use sectors in order to establish achievable energy efficiency targets for the coming decade. Despite this lack of critical information, it is apparent that there will be a need for expanded energy supplies in the 1990's. Thus, New Brunswick should examine the social and economic development opportunities that exist for energy developments whilst also identifying energy efficiency opportunities in pursuit of environmental goals and sustainable development.

The challenge facing all New Brunswickers is to participate in the development of an energy policy, which not only provides for secure, reasonably priced energy, but also ensures that energy development and use is carried out efficiently and in a sustainable development manner. This document is an initial step in the development of such a policy.

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1.0 Introduction

The Government of New Brunswick has as a major objective the maintenance and enhancement of the quality of life for New Brunswickers. It also has a responsibility for the revitalization and development of the economy of the Province. Energy development and the rate of energy consumption will undoubtedly play very key roles in meeting these objectives.

Energy takes on many forms but it can be thought of in general terms as electricity for domestic, commercial and industrial use, petroleum-based fuels for powering vehicle engines (transportation), heating appliances and industrial boilers, wood for space and process heating and alternative fuels such as solar, wind, tidal and geothermal. Electricity is actually an intermediate stage in the production-consumption cycle. Converting primary forms of energy into electricity simplifies transmission and renders it useful to the end user. Electricity is also the highest value form of energy in terms of being useful in applications where other energy forms are not suitable.

The most significant fact about energy is that it touches and influences the everyday lives of all New Brunswickers. Energy in one form or another keeps us warm in winter, cooks our meals, transports us to and from work, entertains and informs us through radio and TV, mows our lawns, helps to clear away snow in winter, and makes it possible for such vital services as schools and hospitals to function. Energy is also a major contributor to the development of the economy and it creates thousands of jobs for New Brunswickers. It is difficult to imagine the Province functioning without a reliable and secure source of energy and any energy policy must ensure that this situation continues.

Historically the Canadian economy has evolved from an energy-using society of wood and coal to oil and has now reached the stage where primary energy use is from a variety of sources (See Figure 1). Sectors such as transportation still depend largely on a single source of energy (oil) but, in general, the diversity of energy supplies makes Canada and New Brunswick more flexible and adaptable to changes in both price or availability. Canada is one of the world's largest per capita users of energy and, although use has decreased somewhat since 1973, this distinction still stands today.

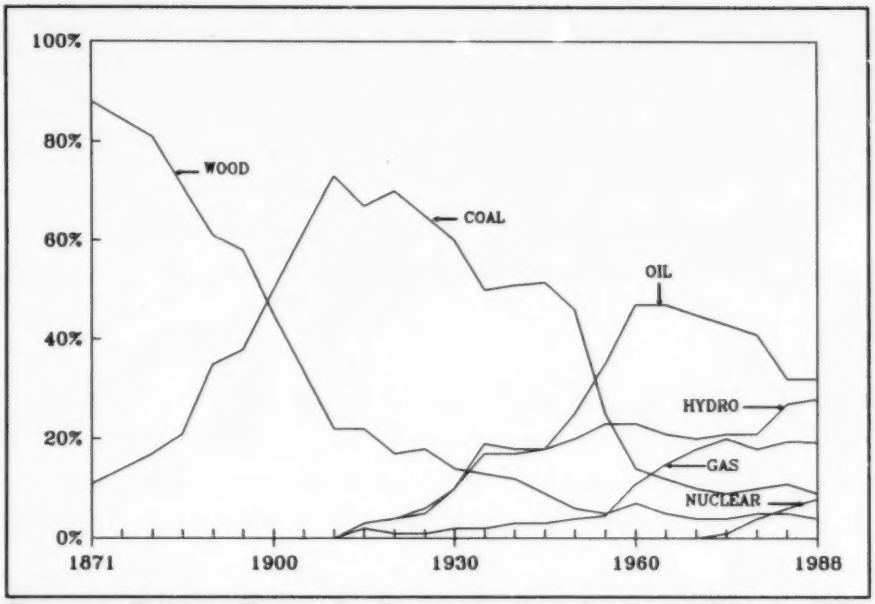

Figure 1 ***Primary Energy by Source in Canada from 1871 to 1988. Source: Energy Mines & Resources Canada.***

An outlook model by Energy, Mines and Resources Canada indicates that, although there will be a modest reduction in the growth of Canadian energy use over the next 15 years, a 47% rise in energy consumption is predicted between 1988 and 2005. It is safe to say that the New Brunswick situation is relatively close to this national energy use prediction for the 1990's.

Energy planning for the future involves the determination of the appropriate mix of supply and demand initiatives needed to meet the energy needs of a particular area. Energy is so vital to the Province's livelihood that there is very little room for error and, since some energy supply sources require long time periods to develop, the Government must plan now for facilities that will not become operational until well into the 1990's At the same time, energy must be consumed more efficiently or conserved, thus lessening the demand for energy. An energy policy and planning exercise must also take into account the effects of energy development and use on the environment. No form of energy is completely without impact so a balance must be struck between the economy and the environment through sustainable development.

This report first of all outlines the role of governments and the private sector in energy development. Energy supply and demand is discussed in some detail, including

indigenous and imported energy supplies and projections of electrical energy demand to the year 2000. Energy efficiency and conservation is dealt with and presented as a cornerstone and major initiative to help meet the expected energy needs of the future. The electrical energy development section outlines a number of major projects being considered to help meet the demand through the 1990's. The environment and sustainable development, a vital element of an energy policy for today, is then discussed in some detail. The final sections deal with transportation and the need for research and development.

This document is an initial step in the development of a Provincial energy policy and is intended to serve as a background discussion paper for the public consultation process. Input obtained from the public hearings will be carefully analyzed and used in developing an energy policy for New Brunswick up to the year 2000.

2.0 The Role of Government and the Private Sector in Energy Development

The role of governments in the formulation and implementation of energy policies and energy development initiatives is very extensive and is reflected in such devices as legislative Acts and Regulations, boards and commissions and other administrative agencies. Coordination of energy policy between the Province and the Federal government is often reflected in cost-sharing agreements and other joint developments and it is important that these arrangements continue in the future. New Brunswick's international relationship on energy matters is usually coordinated through the federal government and it, in turn, is a member of such organizations as the International Energy Agency. Federal energy activities that impact on the Province the most are those of the National Energy Board. The Department of Natural Resources and Energy is the Provincial agency responsible for energy matters other than the generation, transmission and distribution of electricity which rests with NB Power. Government policies must also take into account the activities of the private sector which plays a major role in energy supply and demand.

2.1 International

The International Energy Agency (IEA) was established in November, 1974 as a result of the oil crisis and is "a transnational forum under the aegis of the Organization for Economic Cooperation and Development (OECD) to defend the collective economic and energy security interests of the industrialized, oil-consuming nations". The membership consists of 21 of the 24 OECD countries and Canada is included. IEA's priority is to carry out "a program of cooperation designed to enhance the collective energy security of member countries by reducing group dependence on oil imports, sharing oil supplies in an emergency, and promoting more stable conditions in the world oil market". It also promotes energy efficiency and conservation, oil substitution, diversification of energy sources and the importance of market-oriented energy and pricing policies. The IEA is the international stage for Canada to pursue its energy policy interests. It also follows that it is New Brunswick's connection to international energy policies.

The Northeast International Committee on Energy (NICE) was established by the Conference of New England Governors and Eastern Canadian Premiers in 1978 to address regional dependence on offshore sources of energy fuel supplies. It also provides

public officials, trade representatives, and industry executives with a forum for information exchange and a workplace to cooperate on energy issues of mutual benefit.

2.2 *Government of Canada*

Responsibility for federal energy policies and activities rests with Energy, Mines and Resources Canada and the National Energy Board (NEB). The NEB is an advisory and regulatory agency that plays an important role in energy matters and reports to the Minister of Energy, Mines and Resources. The Board operates under the National Energy Board Act which gives it wide powers to examine and regulate the activities of energy supply producing companies on federal lands, works of an interprovincial nature (oil, natural gas lines, etc.), and electricity export activities. It issues licences for international transmission lines and may call for environmental impact assessments on provincial proposals to construct generating facilities that would export power. The NEB provides advisory services to Parliament and acts as an independent voice to Energy, Mines and Resources through such activities as regular energy supply-demand forecasts. Other federal energy activities include research and development, promotion of energy efficiency, demonstration projects, and cost-sharing initiatives with the provinces.

Federal energy policies have a clear impact on New Brunswick and it is important to understand them. Embodiments of federal energy policies are reflected in such initiatives as the Atlantic and Western Accords, natural gas and electricity deregulation and the energy security plan. The most comprehensive federal energy policy statement to date was made by Prime Minister Brian Mulroney in July, 1984 and it is sometimes referred to as the Prince Albert Statement. It was subsequently accepted in Ottawa as a reflection of federal government policy. The policy was "fundamentally intended to unite Canada - economically and politically" and includes as its major goals the development of energy resources as an engine of growth for the benefit of all Canada, energy security and self-sufficiency, fair treatment for consumers and producers, and cooperation among federal and provincial governments. The Government of Canada plans to release an environmental master plan in 1990 and it is expected to focus heavily on energy. The regional economic consequences of these and other federal energy policies will be of major concern to New Brunswick.

The major dividing line between Canada and the Province, in addition to certain regulatory functions, is in the developmental, resource ownership and management areas.

New Brunswick's responsibilities are clearly in these areas but, at the same time, it looks to the federal government for the majority of research and development activities, help to ensure a secure supply of energy, and assistance for energy efficiency and development projects.

2.3 Provincial Government

The Department of Natural Resources and Energy (DNRE) is the provincial agency responsible for all energy matters other than the generation, transmission and distribution of electricity. The Minister of the Department is charged with the responsibility for setting, implementing and coordinating the Government's energy policy in cooperation with the Chairman of NB Power. DNRE has an Energy Management Program that supports energy efficiency and the development of indigenous energy resources. The program also assists in research, demonstration and promotion of the efficient use of energy, oil substitution and new technologies to help reduce the Province's vulnerability to future energy price increases. Current energy-related Provincial legislation includes:

1. Oil and Natural Gas Act - All oil and natural gas in the ground is separate from soil and is the property of the Province. The Act sets out the rules for exploration, allocation and extraction of oil and natural gas.
2. Pipe Line Act - Pipeline refers to a flow line, gas line, oil line, mineral line, secondary line, distribution line or private line as determined by the Minister. It does not cover interprovincial lines which are Federal matters. The Act provides for the issuing of permits for construction and inspections and may involve hearings before the Board of Commissioners of Public Utilities.
3. Gas Distribution Act - Provides for the awarding of gas distribution rights.
4. Gas Public Utilities Act - Provides for the regulation of gas distributors and distribution systems.
5. Gasoline, Diesel Oil and Home Heating Oil Pricing Act - Provides for the regulation of prices, dealer margins, posting of prices and promotional merchandising
6. Bituminous Shale Act - Provides for the regulation of exploration, development and production of oil shales
7. Underground Storage Act - Provides for the regulation of exploration,

development and operation of underground cavities, natural or artificially made, that may be used for storage of liquids and gases.

8. Gasoline and Motive Fuel Tax Act - Provides for the levying of taxes on refined petroleum products and the licensing of outlets.
9. Public Utilities Act - Provides for the regulation of companies supplying what is considered to be a public utility such as telephone, natural gas and some pipelines. As a result of recent Legislation amendments, NB Power must go before the Public Utilities Board to obtain authority to change power rates. These amendments include the establishment of an intervener to represent the interests of the public.
10. Mining Act - Insofar as it applies to coal exploration and development.
11. Electric Power Act

2.4 NB Power

The electric power industry in Canada has evolved largely under the auspices of provincial government ownership of utilities as a matter of public policy. In New Brunswick, NB Power was established as the Province's agent to develop and maintain the electrical infrastructure. The utility is owned by the Province and its mandate is clearly spelled out in the Electric Power Act. The Act establishes a government appointed Commission that gives it the necessary authority to carry out the following mandate:

- Provide a continuous supply of energy adequate for the needs and future development of the Province; and,
- Promote economy and efficiency in the generation, distribution, supply, sale and use of power.

The Commission itself is a body of up to 10 Government-appointed members, one of whom is to act as Chairman. Traditionally, the Chairman has been a member of Cabinet and the members of the Commission have been selected to give broad regional representation within the Province.

Management of the utility receives policy direction and spending authorization from the Commission. Management's role is to advise the Commission and to carry out

the Commission's policy directions, and operate the utility so as to satisfy its mandate effectively and efficiently. NB Power today is a multi-billion dollar utility serving directly and indirectly over 303,000 customers throughout New Brunswick. Total fixed assets committed to providing electrical service are about $3.1 billion. Revenues in 1988-89 totalled $856 million, of which $241 million came from sales outside of the Province.

2.5 *Federal-Provincial Energy Agreements*

A review of past energy agreements and their benefits is very helpful in understanding their impact and importance to New Brunswick. The Conservation and Renewable Energy Demonstration Agreement (CREDA), which ran from 1980 to 1985, was particularly successful in New Brunswick and has been regarded as one of the best programs of its kind in Canada. Under CREDA the Province was able to initiate the Wood Energy Program, which by March 1986, had supported 21 projects in research, development and demonstration with spending at $5.9 million. Many new technologies in energy efficiency were also evaluated and demonstrated under CREDA. These included demonstrations of technologies such as heat pumps and heat recovery equipment and automated energy management systems of the type that was installed at Mount Allison University.

Under a series of industrial/commercial energy agreements the Energy Audit Program was delivered from 1978 through 1986. Through this service more than 2000 small to medium size industrial, commercial and institutional consumers were provided advice and assistance in energy management. Over $22 million in annual energy saving was identified and a valuable data base of energy consumption information was created. Evaluations of similar programs in other Canadian provinces have indicated that substantial investments in energy efficiency resulted in considerable economic impacts, including job creation.

Other types of incentive programs were also successfully delivered under the industrial/commercial agreements. These included funding assistance for detailed feasibility studies as a follow-up to the energy audits and the delivery of workshops and seminars specifically directed at particular sectors.

Between 1978 and 1989, five federal-provincial energy agreements were successfully delivered in New Brunswick. The total spending amounted to $14.2 million

of which $10.5 million was recovered from the federal government. These agreements allowed the Province to evaluate the potential of a wide variety of energy technologies in the New Brunswick context. They provided much needed financial assistance to help promote the proven and the most promising opportunities in energy efficiency and alternative sources.

These initiatives were carried out at a time when energy prices were escalating and public concern was at an all time high. Today a much greater challenge is presented with stable prices and a more complacent society. The need for continued cooperation with the federal government and aggressive initiatives by the Province are ever more important as New Brunswick attempts to maintain industry competitiveness, sustain economic development and maintain a healthy environment.

2.6 *Private Sector*

The government's relationship to the private sector is important because it supplies the major part of New Brunswick's total energy requirements. In 1988 the private sector supplied 79% of New Brunswick's energy compared to 21% supplied by the public sector, in the form of electricity (Figure 2 , Table I). However, the usable energy supplied by the private sector is actually approximately half of that shown due to combustion efficiencies, while that supplied from electricity is in one hundred percent useable form.

Energy supplied by the private sector is particularly evident in the transportation sector where there is virtually no substitute fuel. Irving Oil Limited of Saint John has the largest oil refinery in Canada with a capacity of 250,000 barrels per day. Although refined petroleum product use has declined in the Province since 1980, the resource will continue to play a vital role in the supply of energy needs. It is important for New Brunswick to coordinate its energy policies with the private sector to help ensure security of supply and cooperation in efficient energy use.

The role and contribution of the private sector in transportation and energy efficiency is very significant. These topics are discussed in later sections of the report.

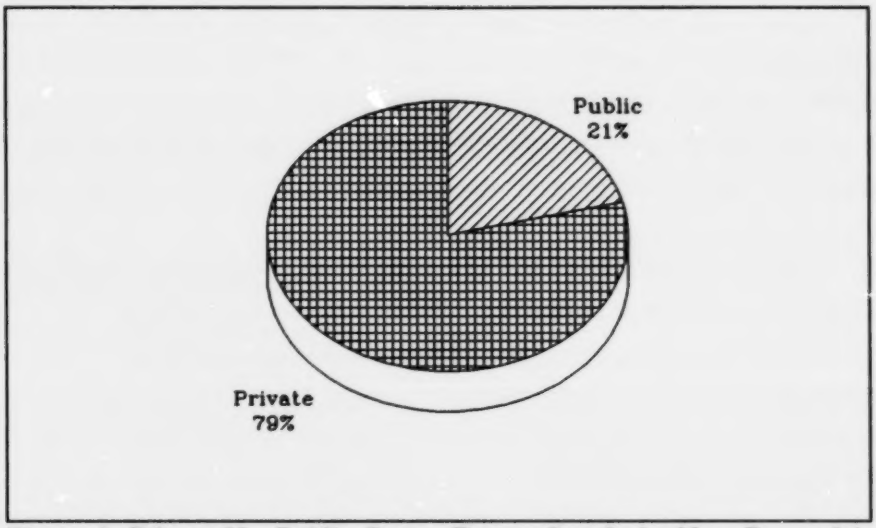

Figure 2 ***Private Vs. Public Sector Energy Supply in New Brunswick, 1988. Sources: Statistics Canada, Cat. #57-202, N.B. Energy Review.***

Table I
Private Vs. Public Sector Energy Supply

Sector	TJ[1]	Percent
Public		
Electricity	43,268	21%
Private		
Wood, Wood Residue	43,608	22%
Refined Petroleum Products	110,914	55%
Other Sources	3,902	2%
Sub Total	158,424	79%
Grand Total	201,692	100%

[1] **One Terajoules (TJ) is equivalent to 165 barrels of oil. For example, 201,692 TJ is equivalent to 33.3M barrels.**

3.0 Energy Supply and Demand

It is important to the Province that mechanisms are in place to ensure that adequate energy supplies are available to meet the demands of New Brunswickers now and in the future. Planning for the 1990's is a detailed process and not a simple matter of matching supply with demand due to the complex social and economic conditions that must be taken into account. Security of supply is a major concern and it means that it is more prudent to diversify energy sources and, at the same time, utilize indigenous fuels. Concern for the environment is now foremost in the minds of citizens and must be considered when planning for a mix of energy fuel supply sources. The present and future demands of New Brunswick households as well as those of industry are also major elements of the planning process. (See energy consumption in New Brunswick by primary source and end use, Figures 3 and 4)

3.1 Provincial Energy Resources

New Brunswick has limited natural energy resources, nevertheless, those that are available are significant and must be seriously considered as part of a strategy of energy security. The utilization of these resources is an important part of the Province's economic development plan and preference should be given to local and indigenous fuel, if costs and environmental consequences are similar to imported fuel sources. In future, the Province's natural resources are expected to continue to play a significant role in energy supply allocation.

Oil and Natural Gas

Despite the 1909 discovery of oil and natural gas at Stoney Creek in Albert County and its almost continuous production until recently, all other exploration activity to date have failed to find further commercial discoveries. Geologists, however, believe that the sedimentary rock sequences in the Moncton Sub-basin (inland) and the Fundy Basin (offshore) offer considerable potential for such discoveries.

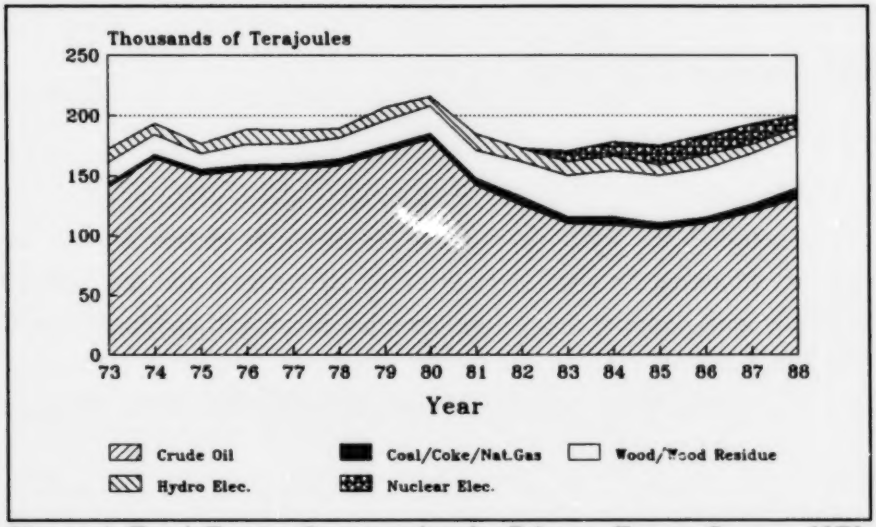

Figure 3 ***Total Energy Consumption by Primary Energy Source, 1973-1988.***[2]

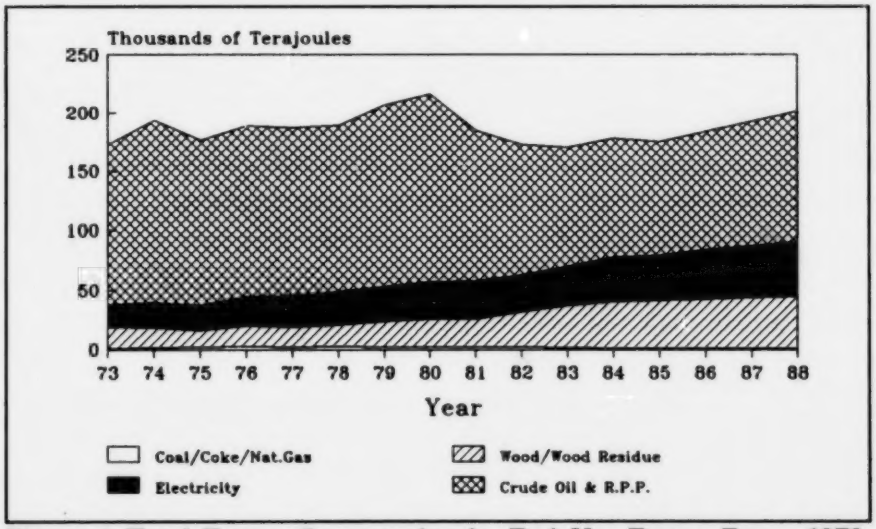

Figure 4 ***Total Energy Consumption by End Use Energy Form, 1973-1988.***[2]

[2] Sources: Statistics Canada, Cat. #57-202, Quarterly Report on Energy Supply Demand in Canada, 1978-1988. Statistics Canada, Cat. #57-003, Quarterly Report on Energy Supply Demand in Canada, 1973-1977. New Brunswick Energy Secretariat, New Brunswick Energy Statistics, 1973-1979. New Brunswick Energy Secretariat, New Brunswick Energy Review, 1982-1985.

Oil Shale

Preliminary estimates indicate that New Brunswick's oil shales contain 3 billion barrels of oil "in place" in beds yielding greater than 50 litres of oil per tonne of rock. Present oil prices and technology preclude the economic development of these oil shales but the Province has continued to encourage exploration and research on technologies which may lead to development at some future date.

Coal

New Brunswick has 20 million tonnes of proven coal reserves in the Grand Lake and Beersville coalfields. There is also a resource potential of a further 20 million tonnes which could be surface mined. New Brunswick's coal, which has a characteristically high sulphur content, occurs in seams with an average thickness of 0.5 m or less. The thin seams result in a high strip ratio. In the Minto/Chipman area the average strip ratio is greater than 60:1, which means on average more than 30 m of material has to be removed to expose 0.5 m of coal. In most coal producing parts of the world the strip ratio is 10:1 or less.

New Brunswick's annual coal production is currently in the 525,000-550,000 tonne range and it is utilized completely by NB Power at the Grand Lake and Dalhousie generating stations. Work is being carried out to determine the development potential of the Beersville, Kent County deposit. This work will involve drilling to determine seam thickness and continuity as well as digging a test pit to determine mining characteristics, pit floor conditions and acid mine water generation potential. A bulk sample of coal produced by the test pit operation will be used to determine burn characteristics. This work is required to verify seam characteristics, coal quality and to determine whether the deposit can be mined economically and in an environmentally acceptable manner.

Wood

Wood offers one of the most obvious energy alternatives since about 85% of New Brunswick is forested. Of particular significance is the amount of wood and wood residue used as a source of energy in the commercial, residential and industrial sectors. Wood used for space heating in the Province is equivalent to the amount that would be required to fuel a 250 MW electric generating plant. The current annual consumption of

wood for energy is 1.35 million dry tonnes (dt), which represents 22% of total primary energy use in the province (See Figure 3). This represents a displacement of imported fuel equivalent to about 650 million litres of heavy fuel oil annually. This volume includes about 500,000 dt for home heating and almost one million tonnes in the form of wood residue produced and used essentially by the wood products industry. (Table II).

Table II
Wood and Wood Residue Consumption 1987[3]

Sector	Dry Tonnes (dt)	Terajoules
Commercial / Institutional	41,500	800
Residential	496,600	9,900
Industrial	810,300	16,200
Total	1,348,400	26,900

Only small quantities of forest harvesting residues are presently being processed into chips and used as fuel. Recent studies indicate that a sustainable annual supply of wood residues amounts to approximately 3 million dt. Considering the economics of conversion of existing oil consuming facilities, and of new wood fuelled facilities to wood residue, the projected total annual use of wood and wood residue could be about 2.3 million dt by the year 2008.

The pulp and paper industry consumes the bulk of the wood residue supply. In recent years many installations of wood fired boilers in the institutional sector have also demonstrated the viability of the use of wood residue on a smaller scale. A project is underway to evaluate the feasibility of the combustion of wood with coal for electricity production in the circulating fluidized bed boiler at NB Power's Chatham plant. Additionally, the Province is proceeding with a public call for proposals to build and operate a 25 MW wood-fired electric generating plant in the Sussex area.

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[3] Terajoules are expressed in terms of useable energy. Source: Neil & Gunter and Resource Management Consultants Study, 1989 - Socio-economic Impact of Wood Energy. N.B. Department of Natural Resources and Energy.

The socio-economic benefits associated with the use of wood residue for energy can be significant and, depending on end-use, may outweigh those associated with imported fuels. However, wood as a fuel for electric power generation alone has a higher cost compared to other fuels and this may negate the growth of wood-fired power generation at this time. It must also be considered that there are many competing demands for our limited wood resources and the socio-economic benefit of these uses together with the carbon emissions from wood must be weighed.

Hydro

Hydro is an indigenous resource that helps to reduce the Province's reliance on offshore oil. NB Power's electrical generating system is a combination of hydro and thermal, each of which meets baseload or peak (high) electrical demand. Hydro stations normally handle the peak load demand, thus their importance to the system is critical. Hydro uses falling water to generate electricity and is one of the most common and economical ways to supply energy. It also offers operational and environmental advantages over other production facilities. NB Power's current hydro supply consists of six generating stations, the largest being Mactaquac with installed capacity of 653 MW The other plants and their capacity are listed in Table III, page 24.

Future expansion of hydro is limited since New Brunswick is not endowed with major water storage capacity on its river systems. Two possibilities include a 300 MW expansion at Grand Falls and a 140 MW development downstream at Morrell but these could not be economically realized until after the year 2000.

3.2 External Energy Supplies

It has been pointed out that New Brunswick's natural energy resources are limited and although maximum economic use should be made of them, they alone cannot meet the current and future demands of the Province. External sources must be included if the Government is to meet its obligations of maintaining a secure and reasonably priced supply of energy for New Brunswick. To meet these obligations for the 1990's a mix of external energy supply options are available, including oil, natural gas, nuclear, orimulsion and imported coal.

Oil

Oil remains the dominant transportation fuel and came into common use as the preferred fuel for thermal generation beginning in the late 1960's. At that time it was cheaper than coal, burned cleaner and was easier to transport. The 1973 and 1979 energy crises changed all that and New Brunswick was faced with significant price increases as well as a serious threat to disruptions in supply. (See Figure 5).

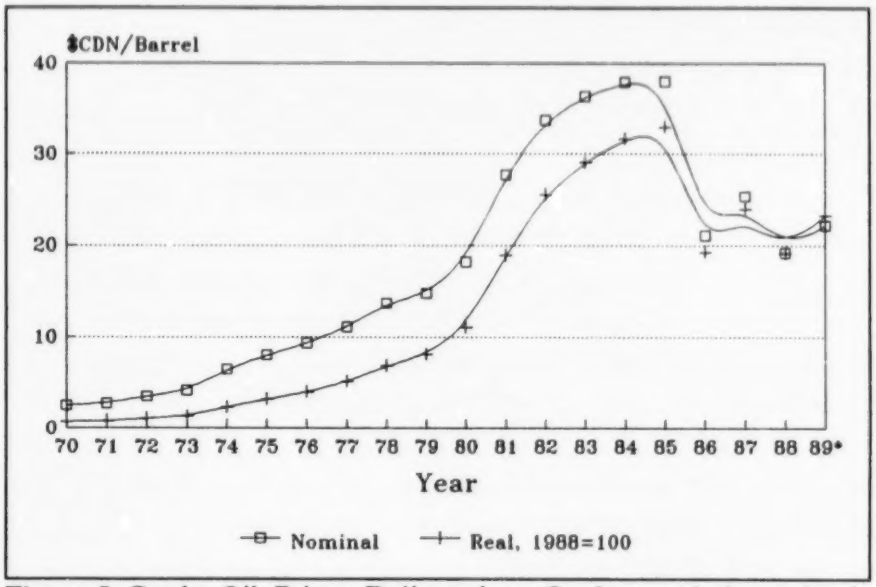

Figure 5 Crude Oil Prices Delivered to Quebec and the Atlantic Region, 1970-1989.

The National Energy Board predicts that oil's share of energy demand in Atlantic Canada will fall only marginally in the next 15 years from 61% in 1986 to 55-57% in 2005. Oil will be increasingly confined to its major captive market - transportation - and although the level of end use demand will increase slowly over the next 15 years, it is expected to remain lower than the 1976 demand.

Despite the major advances made in New Brunswick to get "off oil" subsequent to the price shocks of the 1970's, oil remains the dominant energy commodity whether it is by actual use or by price reference for other energy commodities. Oil is an international trading commodity within the global economy and is internationally priced. Thus consideration of an energy policy for New Brunswick must be set against the history and

future projections of oil supply and pricing.

In considering the global crude oil situation, the most critical fact is that since about 1980 the non-OPEC oil producing countries, excluding the communist-bloc producers, have not been replacing their reserves of conventional crude oil. Consequently, the significant non-OPEC oil-production capacity cannot be sustained for much longer and OPEC will again become the dominant supplier. It is questionable whether OPEC would act as it did in the 1970's, resulting in the price shocks which gave impetus to sharp decreases in oil demand through intensified conservation and substitution. The OPEC action also increased exploration and triggered development of higher priced reserves.

Canada's reserves of conventional oil in the west are generally stable or declining with new areas waiting in the wings, such as Hibernia off the east coast and the Beaufort Sea/MacKenzie Delta region of the western Arctic. Oil from these areas will, however, require prices somewhat higher than current levels to be economic. The real opportunity for oil security in Canada is the oil sands. Underlying nearly 50,000 square kilometres, they are larger in area than New Brunswick and contain more than 1.5 trillion barrels of oil in place. The problem with the oil sands is the high cost of producing a barrel of light crude in comparison to that of some OPEC nations.

Despite Western Canada's large oil reserves they remain inaccessible to New Brunswick as the pipeline stops in Montreal. Thus New Brunswick must draw its oil supplies from offshore and is consequently more sensitive to the global market forces. Despite the initiatives to reduce dependence on oil, it still provided 66% of primary energy consumption in 1986 (Figure 13, page 33) and represents 43% of NB Power's electric generating capacity (Figure 6, page 23).

Natural Gas

Canada has vast reserves of natural gas which are capable of satisfying both Canadian and a growing portion of U.S. demand for the foreseeable future. This energy source appears to be the "fuel of choice" for the immediate future and its use is only limited by pipeline capacity or distribution access.

The Western Accord and the Agreement on Natural Gas Markets and Pricing firmly established the national objective of relying on market forces to determine the fundamental production, pricing and marketing decisions of the oil and natural gas industries. With deregulation, Canadian consumers have enjoyed benefits of lower energy prices, whereas natural gas producers are only now beginning to realize benefits of increased market access.

The 1980 National Energy Program of the federal government included funding to extend the pipeline from Montreal through to Nova Scotia. A private sector proposal was advanced to construct a natural gas pipeline from Lévis, Quebec to Halifax, N.S. The line was to enter New Brunswick near Edmundston, proceed through the Province in roughly the same corridor as the Trans-Canada Highway, and exit into Nova Scotia at Amherst. A lateral line was proposed to extend over to Belledune and on to Newcastle-Chatham. It was also thought that, due to the possibility of east coast gas from Sable Island, the line should be reversible. The proposal included a large measure of Federal support but this ended with the cancellation of the National Energy Program.

Since that time, natural gas has been deregulated and development in western and central Canada is proceeding on a market-oriented pricing regime. Federal thinking has now changed in that it is acceptable to consider natural gas as a fuel for thermal generation. The alternative to western gas, Sable Island, is still in the exploration stage and no closer to reality.

Natural Gas is the cleanest burning fossil fuel readily available at this time and the preferred fuel where available for the next decade and beyond. It offers considerable environmental benefits when compared to other fossil fuels. The American Gas Association has stated that natural gas for industrial use can reduce carbon dioxide by about 50% per unit of energy output over coal; by 65% per unit of electricity in electric generation over coal; and by about 30% per kilometre over gasoline or diesel fuel in transportation.

It seems appropriate for the Province to explore opportunities for bringing Western Canadian natural gas into New Brunswick as well as continue to monitor the possible development of natural gas off Canada's east coast. Liquified natural gas (LNG) should also be examined as a possible alternative.

Nuclear

Thermal generation of electricity using nuclear fuel is now common throughout the world. This option is beginning to attract more interest in response to a growing demand for reductions in atmospheric emissions. The nuclear reactor currently in operation at Lepreau is a CANDU type that was designed, built and proven in Canada and has an excellent record for safety, reliability and economy. The CANDU system continues to be a world leader in nuclear performance and is strictly regulated by the Atomic Energy Control Board (AECB) including design, construction, commissioning and day to day operation.

The 630 MW CANDU Point Lepreau project was initiated in 1975 and went into service in January, 1983. All phases of the project were strictly controlled by AECB and the impact of the development on the environment and community life was closely regulated. Lepreau's performance is exemplified by the fact that, of the world's top 10 nuclear plant lifetime performers to the end of 1987 in a field of 260 reactors, seven were Canadian and Lepreau was number one.

It is recognized that compared to nuclear, a coal-fired plant is presently cheaper to build but more expensive to operate. Estimates of lifetime economics for coal and nuclear favour coal in the early years and nuclear in the long term so that the overall comparison is difficult to predict. However, the environmental advantages of no air emissions make nuclear an attractive energy option. Additional thermal generation using nuclear fuel is a major energy supply alternative for New Brunswick.

Public perception related to the long term disposal of nuclear wastes has been a detriment to the industry. Most experts agree that spent fuel and nuclear waste can be managed with existing technology and practices. The burial of spent fuel in granite rock in the Canadian Shield looks very promising as a permanent solution.

Orimulsion

Orimulsion is an emulsified hydrocarbon product consisting of about 30% water and 70% Orinoco bitumen. Although it is a single sourced fuel (Venezuela), it has potential economic advantages in that it falls outside of OPEC pricing arrangements and is being made available at coal-related prices.

NB Power has completed an extensive demonstration program of Orimulsion fuelling, carried out in co-operation with the Venezuelan producers at its Dalhousie generating station. The tests proved the technical feasibility of Orimulsion as a plant fuel, but also confirmed the need for extensive reconstruction of boilers originally designed for heavy oil fuelling if plant output is to be maintained.

The cost of such conversion, combined with relatively low levels of oil pricing, has made Orimulsion fuelling of such facilities as the Coleson Cove plant uneconomic to date but the concept is being reconsidered in the light of developing circumstances.

Imported Coal

High grade coal from world sources is in abundant supply and New Brunswick's strategic geographical location gives it year round marine access to markets located both in the Atlantic and Pacific trading regions. Imported coal is planned as a primary fuel for the multi-fuelled plant at Belledune.

3.3 Alternate Energy

Beyond the conventional energy sources are a series of alternative options including sources such as solar, wind, tidal, bioenergy, geothermal, and hydrogen. Although low energy prices in recent years have reduced the level of enthusiasm for these sources, they continue to contribute to the energy sector in Canada. Considering that conventional energy sources will become more expensive to exploit in the future, due to depleting reserves and increasing environmental mitigation costs, the relatively clean alternative sources should become more competitive.

Solar

In the field of solar technology, there are three types of systems to capture radiation from the sun. Active solar heating systems consist of collectors for gathering the sun's energy, and pumps and pipes for distributing heated fluids from the collector to a building or heat storage reservoir. Photovoltaic systems consist of solar cells used to convert the sun's energy directly into electricity which is then immediately used or stored in batteries. Passive solar systems are used in building designs with such practices as

orienting the building southward and properly sizing the windows to take advantage of the incident solar radiation.

Active thermal solar applications have received moderate adoption in Canada and in New Brunswick. The most economically attractive applications are for domestic hot water and swimming pool heating systems.

Wind

The exploitation of wind energy in Canada has essentially been limited to small scale turbines for remote applications and to prototype developments. With the recent start-up of the 4 MW vertical axis wind turbine near Cap Chat, Quebec, the total capacity of wind machines in Canada is now near 5.5 MW. The scale and reliability of wind installations and the resulting energy production costs are expected to limit developments to special applications, at least for the medium term.

Biomass

Biomass by definition is essentially compounds made of carbon, hydrogen and oxygen. Modern technology enables us to convert these compounds into a variety of energy forms. In New Brunswick biomass developments have been largely in the area of wood residue fuel from forest harvesting and the wood products industry. Wood contributes such a large proportion to the total energy mix in New Brunswick that it is not considered an alternative fuel but a conventional source. As previously discussed in this document, it represents an energy option with the potential for significant expansion.

Energy-from-waste involves the controlled combustion of municipal garbage and the recovery of heat energy in the form of steam which can be used for space or process heat or electrical generation. There appears to be some potential for energy-from-waste development in New Brunswick, although it is limited at this time. This is because such a plant would have to be relatively large to be viable, and would require the collection of refuse from a larger population base than may exist in a single area of the province. The combination of recycling, composting and landfill remains the most economic option over the medium term.

Other applications of biomass energy are being applied in the form of waste water

treatment with biogas recovery. Such technology is being demonstrated at two pulp and paper plants in the province. The waste water is anaerobically treated and combustible gases are collected and used to displace oil for process heat. Biomass technologies such as this need to be examined for advancement on a broader scale.

Geothermal

The temperature change which occurs with increasing depth below the earth's surface is known as the geothmxmal gradient. Areas with high geothermal gradients, such as hot springs, have development potential for geothermal energy. Thermal gradients in New Brunswick range from low to medium, thus limiting any potential for electricity generation. There may be potential in such areas as greenhouse heating. A drawback to developing geothermal energy in New Brunswick is that those areas with higher geothermal gradients typically have limited populations and consequently limited markets. There may however be significant potential in the use of heat pumps.

Tidal Power

Several schemes exist for generation of electricity from tidal energy but all are subject to tidal cycles and cannot provide a reliable source of electricity for peak demands. This may be overcome by energy storage or use of several basins.

Although it has been estimated that the Bay of Fundy has potential for 1000 to 4000 MW, only 20 MW has been developed at Annapolis Royal in Nova Scotia. Tides are predictable but, unlike the wind, tidal power development is extremely capital intensive and the environmental impacts remain relatively unknown.

Hydrogen

Hydrogen is the lightest and most plentiful element on Earth. It is almost always combined with other elements (natural gas, coal, oil) and is most abundant in water. Whereas energy must be used to break hydrogen free from other elements it constitutes an energy carrier or currency rather than a source of energy.

As an energy carrier, hydrogen is attractive as it has the highest energy density per unit of weight of any chemical fuel and it is clean burning. Research on hydrogen as

a fuel is continuing at the federal and international level but the best prognosis is that we are several decades away from seeing its use.

Summary

In summary, there are numerous other alternative sources of energy with varying potential for future development but they are beyond the year 2000. The technologies discussed and various others have the potential to contribute substantially to future energy supplies and to the reduction of stress on the environment imposed by fossil fuel combustion. The potential of alternate energy sources underscores the need for an increased commitment to research and development in these areas.

3.4 Electrical Supply

In the previous sections it was seen that the supply of electricity in New Brunswick is generated from a variety of indigenous and imported fuel supplies feeding generating stations located throughout the Province. This supply is further supplemented through interconnections with neighbouring provincial and U.S. state utilities. NB Power's present generating capacity consists of 3228 MW from a total of 46 units at 14 locations. (See Table III and Figure 6)

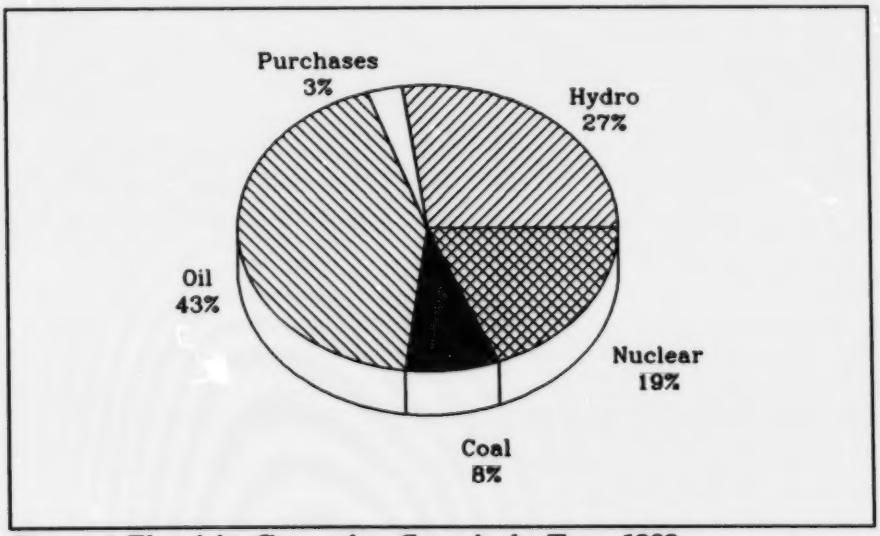

Figure 6 ***Electricity Generation Capacity by Type, 1989.***

Table III
NB Power-Electrical Generating Station Data

Location and Type	No. of Units	Capacity Megawatts (MW)
Hydro		
Mactaquac	6	653
Beechwood	3	115
Grand Falls	4	63
Tobique	2	20
Sisson	1	10
Milltown	7	4
Total Hydro	**23**	**865**
Nuclear		
Point Lepreau	1	630
Total Nuclear	**1**	**630**
Fossil Fuel		
Coleson Cove (Oil)	3	1005
Courtney Bay (Oil)	4	263
Dalhousie (Oil/Coal)	2	280
Grand Lake (Coal)	4	85
Chatham (Coal/Oil)	2	33
Moncton (Diesel)	1	25
Grand Manan (Diesel)	6	42
Total (Oil/Coal)	**22**	**1,733**
Grand Total	**46**	**3,228**

New Brunswick's geographical location has allowed NB Power to pursue strategic interconnections with all neighbouring provinces and utilities in New England. Current interconnection capacity totals 2310 MW. Components of this capability are:

Quebec	1000 MW
Nova Scotia	400 MW
Prince Edward Island	100 MW
New England	810 MW
	2310 MW

Through these inter-utility ties, NB Power has transacted hundreds of millions of dollars in purchases and sales each year. Benefits from this business have kept power rates to in-province customers 13% lower on average than would otherwise have been possible. (See Figure 7)

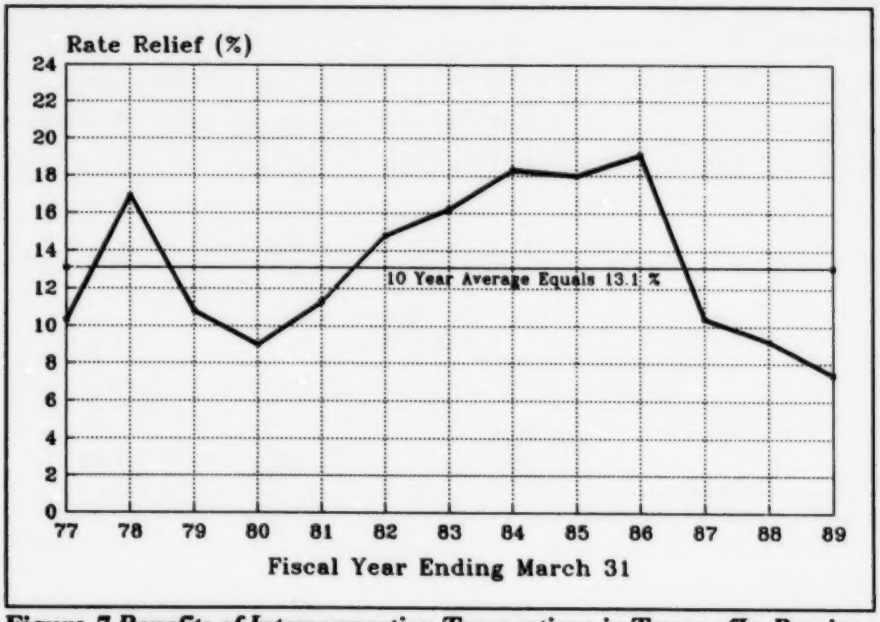

Figure 7 ***Benefits of Interconnection Transactions in Terms ofIn-Province Rate Relief.***

NB Power's benefits from interconnections can be classified as tangible and intangible. The tangible benefits, as we have seen, are manifested by reduced costs as a

result of purchases and sales.

Intangible benefits include improved reliability and stability of the power system that occurs as a result of the interconnections. NB Power calls upon interconnected utilities for purchases during emergencies and extended outages of generating units. A high level of reliability is important to existing customers, as well as customers considering locating in New Brunswick. Without the interconnections NB Power would have to install additional generating capacity to meet its needs on a "stand-alone" basis, or otherwise incur more power interruptions, and operate more expensive generation facilities on a standby basis. Export sales also allow NB Power to build units larger than its immediate needs to gain economies of scale, while sharing the costs of construction and the risk should the plant be delayed in completion or experience operating difficulties.

New Brunswick benefits through job creation and expenditures in various industries due to NB Power's activities related to maintaining interconnections and exporting power. It is estimated that, based on NB Power's 1988/89 fiscal year, approximately every $6 million of net income to NB Power was equivalent to a 1% change in power rates to in-province customers. Without the benefits from interconnections, in-province customers would have had to pay in excess of an additional $650 million since 1970 to meet NB Power's costs.

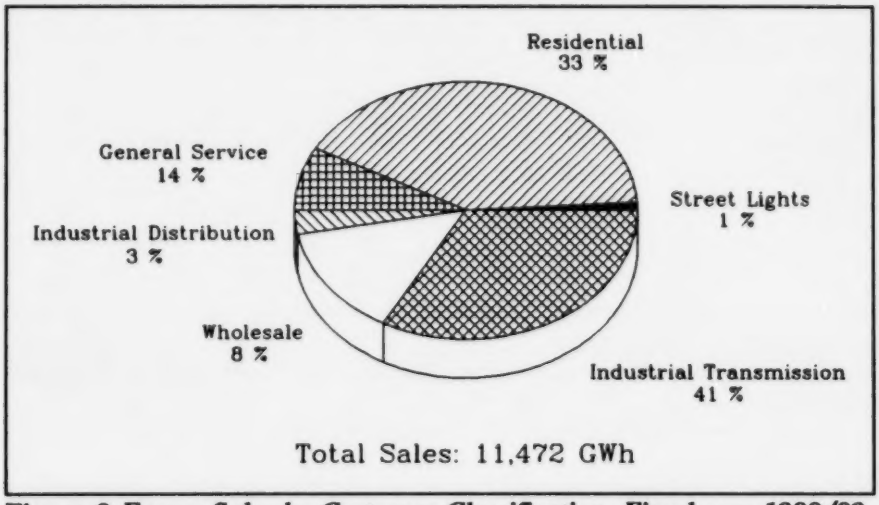

Figure 8 ***Energy Sales by Customer Classification, Fiscal year 1988/89.***

NB Power serves a total of 303,540 customers within New Brunswick, 264,460 of which are direct customers and the remainder of whom are served through municipal utilities in the cities of Edmundston and Saint John. Service to these customers is provided through about 31,000 km of transmission and distribution lines.

3.5 Electrical Energy Usage and Future Projections

Electrical energy usage in New Brunswick has grown at an average of 5.6%/yr. over the past fifteen years. Energy sales in the Province totalled 11,472 Gigawatt hours in 1988-89. The division of sales by customer classification is shown in Figure 8. It is significant to note that 41% of NB Power's in-province energy sales go to large industries. The majority of these sales are for pulp and paper, refining and mining industries. Electrical energy sources to meet in-province load in 1988-89 are shown in Figure 9.

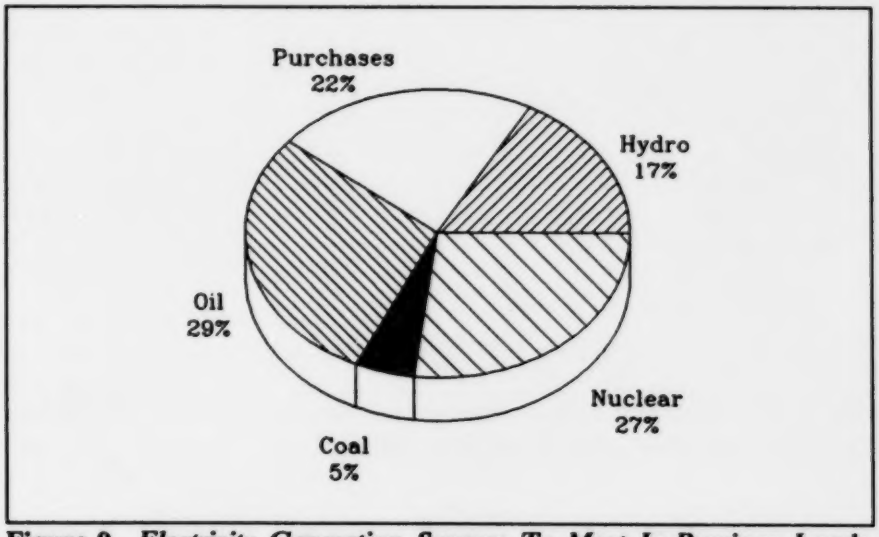

Figure 9 ***Electricity Generation Sources To Meet In-Province Loads, 1989.***

Purchases, which currently comprise 22% of the supply, result from a firm capacity and energy contract with Hydro-Quebec. This purchase is based upon coal price escalations and displaces generation which would otherwise be supplied by imported oil. The contract expires in 1994.

Domestic electricity use is projected to increase at an average annual rate of 2.9% per year over the next 15 years and will be accompanied by a corresponding increase in system peak demand of 80-90 MW per year (Figure 10). This means that, over the 10 year period (to the year 2000), forecasted domestic requirements will increase by 800-900 MW. Continuation of the existing 230 MW of Point Lepreau export sales coupled with additional targeted sales of 400 MW is required to maintain the resulting economic benefits for New Brunswickers, primarily through reduced power rates. In total, the minimum required additional generating capacity in the 1990's is projected to be 1200 MW.

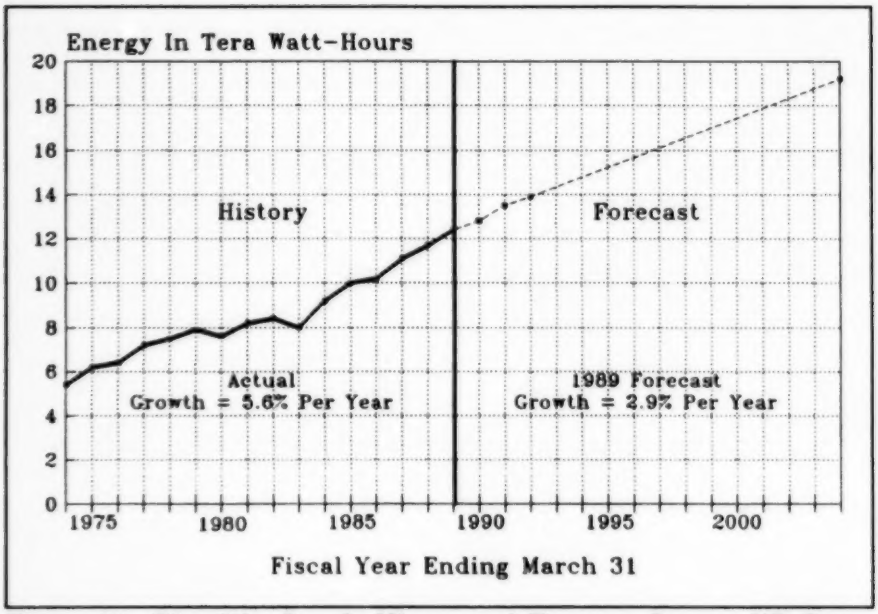

Figure 10 ***Electricity Supply History and Forecast. Source: NB Power Load Forecast 1989-2004, November 1989.***

Electrical usage projections are dependent on many factors including the weather, technological innovation and changes in demand brought about by such developments as energy efficiency programs and the rate of economic growth. Industry, for example, now uses 41% of our electricity and the addition of a new manufacturing plant can significantly alter electricity usage. The usage projections must therefore be treated with caution and updated periodically. NB Power should continue to review the need for additional generating capacity.

It is important to note that electrical energy usage and projections represent only a portion of the total energy picture for the Province. No Provincial total energy demand projections have been completed since 1984 although NB Power annually updates its electrical load forecast. A future energy policy initiative should be the completion of an estimate of the Province's total energy demand and henceforth ensure that this estimate is updated annually.

3.6 External Markets for Electricity

In 1988-89, NB Power exported a total of 5,946 GWh of electricity resulting in revenues of $240.9 million and benefits of $44 million. The breakdown of external sales revenues is shown in Figure 11. External sales revenue makes up 29% of NB Power's total revenue, as illustrated in Figure 12. Benefits from export sales are returned to NB Power's customers through reduced rates.

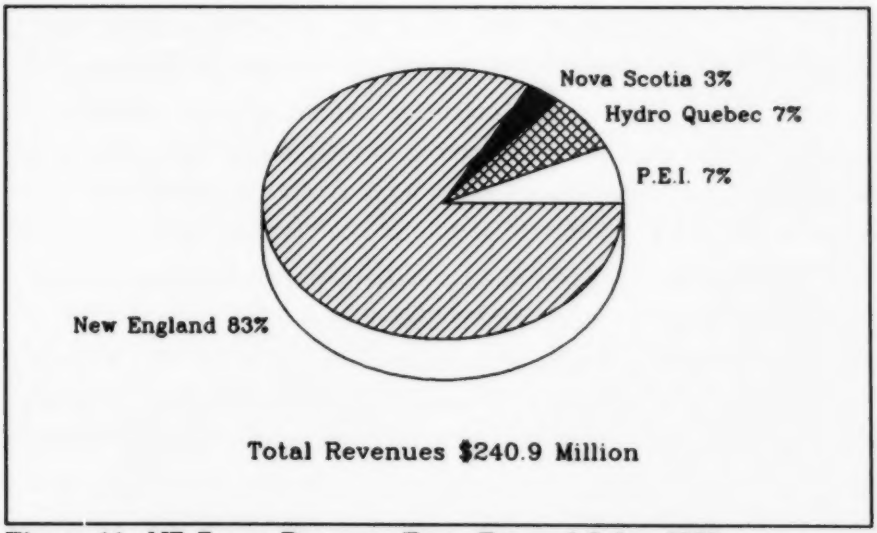

Figure 11 ***NB Power Revenues From External Sales, 1989.***

Since 1970, NB Power's external markets have been the New England Power Pool (NEPOOL), the Nova Scotia Power Commission (NSPC), Maine Public Service (MPS), Eastern Maine Electric Cooperative (EMEC), and Maritime Electric Company Ltd. (MECL). The NEPOOL market has typically represented between 74% and 84% of total sales since 1979.

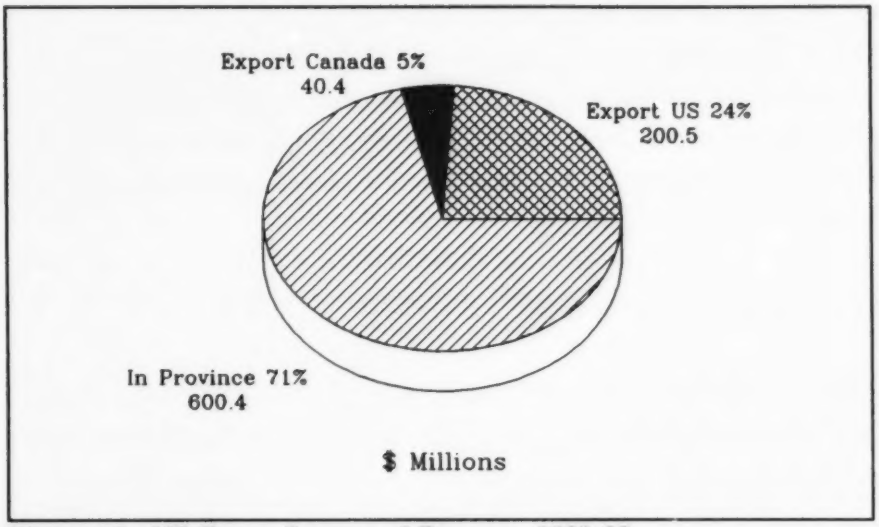

Figure 12 ***NB Power Sources of Revenue, 1988-89***

The forecast of future export sales is difficult to predict because so much depends on the social, political and economic conditions that exist in the target markets. NB Power, through its External Marketing Program, has set specific objectives for export sales. The intent of the program is to maximize benefits through use of existing interconnection facilities and, where economic, strengthen interconnections to market areas. The program consists of the following objectives:

- Continue to supply the total electricity needs of Prince Edward Island
- Extend Point Lepreau export contracts beyond 1991
- Sell 400 MW of base load power
- Increase cooperation with Nova Scotia and Quebec
- Increase transmission access to New England

4.0 Energy Efficiency and Conservation

In the seventies and early eighties energy efficiency and conservation was driven by rapid escalation of oil prices and security of supply. However, the drop in oil prices to $10.00 U.S. per barrel in 1986 and subsequent relative price stability caused a rapid decline in energy efficiency and conservation concerns. This emphasis has again changed as the Canadian and provincial-territorial governments along with International Energy Agency (IEA) partners recognize the importance and cost effectiveness of energy efficiency as an environmentally benign "source" of energy.

Traditionally, energy policies have been developed from the supply-side perspective with much less regard to the demand-side. Today, all levels of government consider energy efficiency and conservation to be a serious option. Thus there is a growing belief that any long term energy strategy should include energy efficiency and that it be considered not simply "conservation", whereby society must do without, but rather the provision of the same or better services using less energy. Unlike the more tangible, primary energy sources such as oil and coal, energy efficiency is a function of the technologies employed to produce goods and services, social behaviour and the structure of institutions.

In considering energy efficiency and conservation as part of a long term energy strategy, extreme care must be exercised to ensure that energy efficiency target levels are realistic and achievable within the New Brunswick economic, environmental and social framework. It is not possible to simply extrapolate energy efficiency potential from other provincial or international jurisdictions, because there are important differences between the end-use structures, behavioral patterns, and capital stocks in different areas. To establish unrealistic target levels without due consideration to the provincial energy scene or to establish an unrealistic time frame, could result in future energy supply-side deficiencies.

Nonetheless, an energy efficiency strategy is a priority in addressing energy environmental, economic and social concerns. Programs must be well planned and directed at specific sectors where "real" efficiency gains can be made. They should be well researched, implementation barriers examined and programs closely monitored to measure effectiveness.

4.1 Benefits

The benefits of energy efficiency are many and are now recognized as having profound effects on the economy and environment. Specifically the benefits include:

- cost saving in all sectors, increasing consumer spending potential;
- increased market competitiveness for New Brunswick's industry by reducing production and transportation cost;
- the creation of sustained employment in design, fabrication and installation of energy saving systems;
- potentially less expensive, less risky and more cost effective than building more energy supply capacity;
- fewer accidents/spills from the production and transport of fuels;
- it is the best means available to reduce significantly all emissions from fossil fuel combustion;
- major quantities of other environmental pollutants are avoided;
- reduction of energy operating costs for government facilities;
- provides greater security against energy price shocks and supply disruptions;
- it promotes the production of higher quality products such as appliances, automobiles, housing, etc. thus improving the quality of life;
- it promotes high technology development through greater sophistication of control and monitoring systems.

4.2 Energy Profile

To more clearly understand the issues of energy efficiency and where to begin with more controlled energy use, it is important to consider the energy consumption profile of the province. Figures 13 and 14 illustrate the proportions of the various energy forms used in New Brunswick and the distribution of energy use by sector. In Figure 13 the dominance of imported oil is evident as well as the little recognized importance of wood. Figure 14 illustrates where the energy is used by sector. These energy consumption patterns carry definite implications relative to energy efficiency priorities.

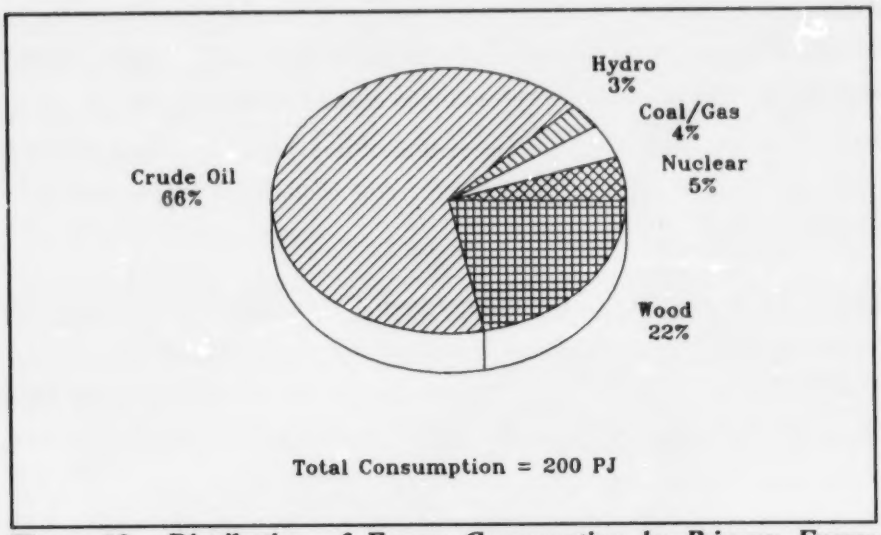

Figure 13 *Distribution of Energy Consumption by Primary Energy Source, N.B., 1988. Sources: Statistics Canada, Cat. #57-202., Quarterly Report on Energy Supply Demand in Canada, 1978-88.*

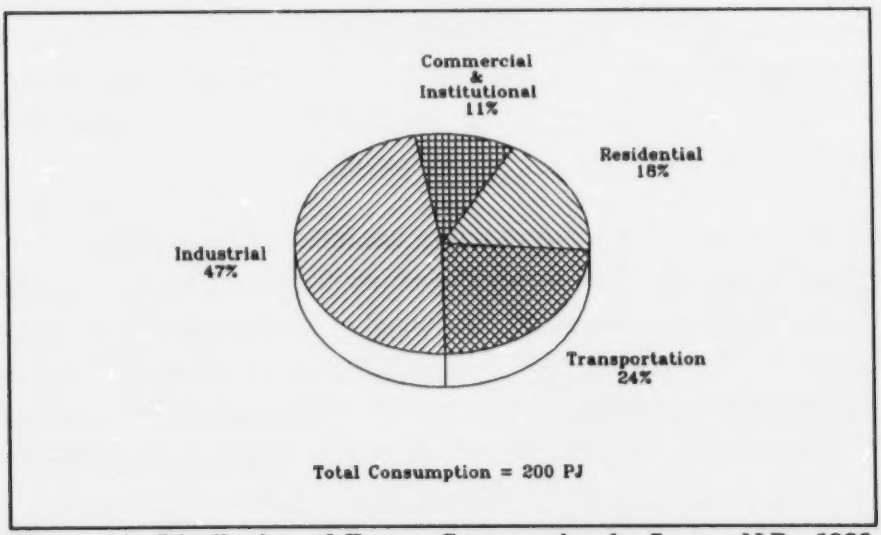

Figure 14 *Distribution of Energy Consumption by Sector, N.B., 1988. Sources: Statistics Canada, Cat.#57-202, Quarterly Report on Energy Supply Demand in Canada, 1978-88.*

By translating the energy use data into environmental pollutants information, such as that showing the carbon dioxide emissions associated with energy consumption by sector, the energy and environment link is illustrated. (See Figure 15, page 47). It is apparent that any initiative to reduce environmental stress through managing energy use

must be applied to all sectors. Even though there will be components of the major sectors that will deserve priority, each of the major sectors, as a whole, offers significant opportunities for energy efficiency improvement and emissions reduction.

4.3 Potential Savings

An accurate assessment of the energy saving potential in New Brunswick has yet to be undertaken. However, provided it is recognizing that considerable differences exist in end-use structures, behavioral patterns and capital stocks, it is possible for discussion purposes to use the experiences in other Canadian provinces, the U.S. and other countries.

The U.S. government's most complete analysis of efficiency potential found that traditional but thorough retrofits, using 1979 technologies and very conservative 10 year average measure life, could save about 50% of U.S. residential space heating energy. Furthermore, the same study suggested that the fuel intensity of U.S. industry could be reduced by about 30% during 1977-2000. Despite the rejection by many analysts of this target, the reduction was achieved via both technical improvements and shifts in composition of output by 1985.

In the United Kingdom a recent report has indicated that the potential energy saving in the domestic scene was: more efficient appliances - 40% energy savings by 2005; more efficient cookers (including the spread of microwaves) - 20%; water heating - 10%; and more efficient lighting -65%. What determines the level of energy savings is the rate of penetration of the available improvements into the stock of buildings and appliances. Thus, despite this potential, not all of it is thought to be achievable.

Other studies in Canada and the U.S. have identified major energy efficiency opportunities. In the residential sector, for example, energy consumption is reduced by 70% in new R-2000 homes and the potential for savings of 15-60% exists in new appliances. In the commercial sector, savings of 55-70% in new buildings and 10-30% in existing buildings can be achieved. In the industrial and institutional sector major cost effective energy saving opportunities exist in electrical load management, the use of heat pumps, cogeneration, improved combustion efficiency and high efficiency electric motors.

4.4 Obstacles

Business and consumers alike can become indifferent to improving energy efficiency in periods of reasonably stable and relatively low energy prices. This can result in a situation where substantial improvements in energy efficiency are not likely to occur if left to market forces alone.

Market forces also do not always fully reflect the best interest of consumers or society. Governments have historically attempted to correct market place failings in an effort to improve the market's effectiveness and responsiveness to social needs. Legislation or regulations directed to protect human health, safety, and the environment are examples. Many now argue that market forces inadequately reflect the environmental quality interests of society. It is for these reasons that some governments are tightening environmental standards and most have placed environmental issues high on the public policy agenda.

The most prominent market failings for energy efficiency include a lack of information on the cost effective opportunities, a focus on low initial capital cost rather than life cycle operating costs, perceived financial and technical risks, lower financial benefits to individuals but large benefits to society, and over emphasis on short term returns.

A further obstacle to New Brunswick is the amount of pressure the province can bring in the area of transportation efficiency where vehicle manufacturing is in Central Canada and the U.S. A similar situation exists for appliance efficiency standards. In both cases, however, the province can play an advocacy role at the federal government level to promote increased energy efficiency.

4.5 Initiatives

Governments have traditionally addressed barriers to energy efficiency and conservation through information, product and technology research, development and demonstration, selective incentives, and public education programs. NB Power has, since the energy crisis of the 1970's, promoted conservation and energy efficiency programs as part of its mandate as defined in the Electrical Power Act; " to promote efficiency in the....use of power".

As administrator of the now discontinued Canadian Oil Substitution program (COSP) and Home Energy Conservation Loans (HECL) programs and more recently the sponsorship of the Conservation and Electrical Improvement Loan (CEIL) program, NB Power has and continues to promote energy efficiency and safety in the use of electricity. The utility also participates in the Energy Efficiency (EE) programs sponsored by the Canadian Electrical Association as well as the Residential R-2000 program. Computerized heat loss calculations and market research into improved technologies for use of electricity have also been some of the services provided by the utility.

Energy efficiency programs are greatly varied in approach and cost. Many models have been delivered in other jurisdictions with measurable success rates. The program options themselves must be evaluated for their applicability to New Brunswick as well as their resulting benefits and costs. Typically the most popular mix of programs is one which is in effect, revenue neutral. This means that the programs which result in a net revenue to the implementing agency, generally government or utility, will cover the expenses of the programs that are net cost creating a balance. Initiatives to increase energy efficiency include:

- **Energy performance standards** have a profound effect on the energy efficiency of energy consuming systems. For example, efficiency standards for vehicles have had and will have in the future the greatest impact on fuel consumption and emissions from the transportation sector. Ontario has developed and is legislating minimum performance standards on major household appliances as has already been done in the U.S. New Brunswick has joined with the other provinces to urge the federal government to institute similar standards nationally to prevent the dumping of inefficient equipment elsewhere. Such standards will have a profound effect on the energy consumed in the residential sector, with the resulting reduction in fossil fuel required to produce electricity. Similar activity is taking place with respect to building standards and the National Building Code.

- **Demand-side management** (DSM) schemes are maturing in the U.S. and have started to appear among Canadian and European utilities. Recent examples of this include the provinces of Ontario and British Columbia. Ontario Hydro is undertaking one of the most ambitious electrical demand management programs in North America, as it plans to reduce the demand for electricity by up to 5,500 megawatts by the year 2014. B.C. Hydro's "Power Smart Program", launched in

1989, proposes to spend $225 million over 10 years to achieve a load reduction target of 2300 GWh/year by 1998. This is slightly more than the total electrical energy produced by all the hydro dams in New Brunswick in 1988, or slightly less than half of the output of the Point Lepreau Generating Station.

A renewed emphasis on energy efficiency is the focus of new programs being implemented by NB Power. The Energy Management Program targets new initiatives including customer awareness programs, demonstration projects, efficient lighting programs (including street and area lighting), energy audits and restructured loan programs which promote energy efficiency. In its plan to meet the future power supply needs of its customers, NB Power is integrating comprehensive demand and supply side options to arrive at a balanced development program.

DSM programs have become flexible tools allowing utilities to effect conservation, peak load shaving, load shifting, valley filling or load building depending on their operational objectives. The overall end result is greater efficiency of use of electrical energy.

- **Efficient energy use by Government** which presently spends about $38 million annually in Provincially owned buildings and $12 million on vehicle fuels. Data obtained under a Provincial Energy Management Program and preliminary analysis of the energy intensity levels of all government owned buildings shows the potential for improved energy efficiency to be about 95 million kWh which is equivalent to $3.7 million ($ 1988) annually. Of this potential, 28 million kWh or $1.1 million could be achieved by simply providing building managers with knowledge of available efficiency opportunities.

  Based on past experience in measuring combustion efficiencies and statistics generated from 2000 energy audits in New Brunswick, it is conservatively estimated that a 2% improvement in combustion efficiency could be achieved by an oil fired boiler tune-up program. Annual savings would be 9.5 million kWh or 900,000 litres of fuel oil, equivalent to $156,000.

  By implementing energy efficiency in buildings and vehicle fleets under its direct control, Government can lead by example as well as reducing its operating costs.

- **Awareness** is a key component of any energy management program as well as the knowledge of the benefits of energy efficiency. Specifically targeted information programs not only change attitudes toward energy waste and the impact on the environment, but they also provide a feedback process. Such feedback is vital market information for the enhancement of efficiency programs and the regulatory process. An excellent example of an information program is the Energy Education Program where support was provided to a network of teachers, with an interest in teaching energy and environment subjects, to conduct various energy activities in the classroom. Another example was ProTrucker which was an energy efficiency information program targeted at the trucking industry and delivered through the Atlantic Provinces Trucking Association. (APTA).

- **The industrial sector** accounted for 47% of New Brunswick's total energy consumption in 1988. Despite the significant energy efficiency gains made by this sector in the early 1980's, following the 1979 oil price escalation, it is believed still further opportunities remain.

  Cogeneration, electrical load management, waste heat recovery, high-efficiency motors, adjustable speed drives and other proven technologies provide still further room for efficiency gains.

At present New Brunswick lacks the detailed analysis necessary to establish the potential and achievable energy efficiency targets by sector. Without a careful evaluation of the technological and economic potential for energy efficiency in the Province, there is an inherent risk that realistic goals may not be established and future supply deficiencies may arise. There has been frequent mention of a 20% target for decreasing forecasted energy demand. In the absence of a detailed analysis it is impossible to say whether such a figure is attainable or, in fact, whether an even higher target is realistic. An energy efficiency analysis would include a technology assessment and economic analysis of each sector, a market barrier and penetration analysis, priority targets, programs for specific efficiency measures, and an implementation and monitoring plan. The completion of such an analysis would allow the Province to establish specific energy efficiency targets as part of its energy policy for the 1990's.

5.0 Electrical Energy Developments Initiatives

An energy development strategy will require the determination of the appropriate mix of supply and demand initiatives needed to meet the Province's future energy requirements. Although energy efficiency is expected to play a key role in a new energy policy, it alone cannot meet New Brunswick's total energy needs over the next 10 years. This is especially true for electrical energy where an additional 1200 MW will be needed by the end of the century.

The demand for increased electric power production from now to the year 2000 is comparable to the highest growth periods in NB Power's history. These demands are expected to result from normal domestic consumption, exports of electricity and most importantly the need to keep pace with the economic activity required to increase employment and income opportunities for New Brunswickers. A number of initiatives are underway or in the planning stages in order to ensure that the Province can meet its electricity needs through the 1990's. These include electricity purchases, an electrical generation construction program and such other developments as load management, non-utility generation and cogeneration.

5.1 Electricity Purchases

NB Power currently has a multi-year power purchase agreement with Hydro-Quebec which secures energy availability on a firm-pricing basis and which provides options for capacity purchases of up to 300 Megawatts for in-province use. This contract represents the equivalent of 25 million barrels of oil over a 6 1/2 year period and it reduces oil price dependence as well as oil utilization. Without this firm contract, experience verifies that Hydro-Quebec energy would not be available for sale to New Brunswick. The current contract ends October 1994 and provides NB Power with substantial flexibility in its development plan due to the optional nature of the quantities involved.

5.2 Electrical Generation Development

NB Power currently plans to develop a series of new generating plants to help meet the additional 1200 MW of electrical generating capacity needed over the next 10

years. This will require a strategy of developing a mix of energy sources for reasons and circumstances that, in themselves, would offer the maximum social and economic advantages to New Brunswick. Part of the program is electricity export targets which, if reached, could advance the need for establishing more capacity. Also to be considered is how much generating capacity can be reduced as a result of energy efficiency and conservation programs over the next 10 years.

In the section on Energy Supply and Demand, it was explained that New Brunswick's natural energy resources are limited and cannot be depended on to meet all the Provinces energy demands over the next 10 years. Of particular concern is the kind and amount of fuel available at competitive prices to generate the additional 1200 MW of electricity that will likely be required for the next decade. Wood, coal and hydro all have limitations and dependence on offshore oil will continue to be a factor throughout the 1990's. Western Canada has oil and abundant natural gas supplies but the pipelines stop in Quebec. In the east, developments at Hibernia and Sable Island are uncertain and not expected to produce commercially in the 1990's. The viable electrical generation options for New Brunswick are therefore quite limited.

NB Power's first project to help meet the demand for the 1990's is the 100 MW combustion turbine development on the Miramichi which will be operational by late 1991 or early 1992. This additional capacity is required in the short term for peak winter demand and will also serve as a reserve in case of emergencies. This and similar projects supplying peaking power, produce low levels of emissions and can actually help in controlling capacity requirements. A second project is a multi-fuelled 440 MW plant at Belledune. Rationale for the project includes readily available sources of fossil fuel at a fairly reasonable price and the need for additional generating capacity in northern New Brunswick. This project is also underway and will meet the Federal guidelines for emission limits of sulphur dioxide[4]. Belledune is required primarily to meet domestic demand and is critical that it be operational by 1994.

NB Power is also actively considering the option of a 150 MW coal-fired plant at Grand lake. Various clean coal technologies including coal gasification are being assessed to determine which would represent the best way of achieving maximum

[4] Installation of a scrubber at Belledune will reduce generating capacity from 450 MW to 440 MW.

environmental control while at the same time realizing efficient electrical energy production.

Another major project being considered is the development of a second CANDU nuclear reactor at Point Lepreau. Domestic and export market projections indicate that another 450 MW unit should come into operation by the late 1990's. A significant advantage of nuclear over fossil fuel units is that practically no air emissions would result.

Construction of major electrical generation plants result in considerable economic benefits for New Brunswick. A second nuclear plant at Point Lepreau would, for example, inject $1.1-1.8 billion into the Provincial economy over 10 years and result in 5100 person-years of employment and the equivalent of 665-1725 full-time jobs. A formal industrial benefits agreement would also be negotiated with AECL. The Belledune project will also result in substantial dollar benefits, and generate 2883 person-years of employment during construction and 135 full-time jobs once in operation.

These developments when taken together would provide close to 1200 MW of new generating capacity by the year 2000. Opportunities that could potentially arise in the external markets might require advancement of new units or the addition of different types of units to meet specific needs. The question of demand reduction through energy efficiency and conservation will undoubtedly play a role in concluding a development strategy. Discussions leading to the formulation of an energy policy for the Province will help to finalize NB Power's electrical generation development program for the next 10 years.

5.3 Other Developments

In addition to energy efficiency and planned electrical generation developments, there are other initiatives that can be undertaken to help New Brunswick meet its present and future energy requirements. These include load management, private sector initiatives, and cogeneration.

Load Management

Load management is a system of encouraging industry to curtail electrical energy

use during peak household use periods, thus decreasing the peak load capacity requirements. NB Power is currently pursuing this with its Curtailable Load Program. Approaches have been made to industry with an initial response involving 22 MW of curtailable load. Presently, NB Power's system could effectively utilize up to 50 MW of "peak shaving" curtailable load.

Non-Utility Generation

It has been proposed that the Public Utilities Board establish a "fair market price" system, thereby giving the private sector the opportunity to develop energy alternatives from such fuels as wood, peat or other biomass. Under this system NB Power would pay the private sector the equivalent to what it would cost the utility to generate the power themselves. A wood-fired plant planned for Sussex is an example of non-utility generation, as are energy-from-waste initiatives presently being considered in New Brunswick.

Cogeneration

Cogeneration is a process which uses a single source of energy to simultaneously produce electricity and thermal energy, generally in the form of process steam. The overall energy conversion efficiency of a cogeneration system can be as high as 70% compared to a typical conversion efficiency of up to 40% for a conventional thermal power station producing only electricity. Pulp and paper industries in New Brunswick, which presently cogenerate electricity and steam, lower their peak demand from NB Power and meet their energy requirements at a lower overall cost. Wood residue is also used in these plants to further reduce the cost of operation.

Cogeneration offers several attractive benefits including increased planning flexibility and supply diversity with the options of using wood residues and other alternative fuels. It helps defer major capital expenditures and greatly improves the overall efficiency of energy conversion and resource utilization. With its inherent efficiency of fuel use, there is a reduction in total environmental emissions. There is potential for more applications of cogeneration in various industries in the Province.

6.0 Environmental Considerations

One of the Government's major criteria is that energy development be carried out with due respect for the environment and within the context of sustainable development. Concern for the environment is and will continue to be one of the major issues of the future. The environmental factor will probably impact on all major social and economic public policy issues, particularly in the field of energy development. Activities that reduce demand are indirectly favourable to the environment in that they reduce the degree of physical development and therefore reduce such harmful effects as CO_2 emissions. Factors such as energy efficiency have already been discussed under the section Energy Efficiency and Conservation. This section will be primarily concerned with environmental initiatives related to energy development. Of particular importance are atmospheric emissions, probably the most harmful by-product of energy development.

6.1 Sustainable Development

The Premiers Round Table on Environment and Economy describes sustainable development as a term used to describe economic activity which protects and enhances the earth's resources and the environment". The objectives of sustainable development include, among others, maintaining and enhancing essential life support processes such as recycling of nutrients and the cleansing of waters, preserving biological diversity, achieving sustainable use of species and ecosystems and the management of non-renewable resources (e.g. fossil fuels) in the interests of developing a long-term sustainable economy.

The importance of sustainable development is reflected in the fact that it was one of the environmental topics discussed at the 30th Annual Premiers' Conference in Quebec City in August, 1989. The communique stated: "In regard to sustainable development, the Premiers' reaffirmed the commitment of their governments to proceed with continued implementation of this approach in each of their provinces". The environment and sustainable development will be ongoing priorities for the Annual Premiers' Conference and First Ministers' Conference on the Economy. Sustainable development is a concept that will be receiving priority attention from the Premiers' Round Table on Environment and Economy and energy will be included in its deliberations. It is the development theory for the 1990's that will co-ordinate

environmental issues with economic development and its relationship to an energy policy for the future is obvious.

The proper management of the production and consumption of energy is a cornerstone to sustainable development. Energy production has impacts both at the local level as well as at the global level in terms of climate change due to pollutants. Energy production also has impacts over time; short term changes as well as impacts for the very long term, e.g. climatic changes and long term storage of nuclear waste.

6.2 *Environmental Impact Assessment (EIA)*

All major energy production undertakings are subject to the Environmental Impact Assessment Regulations under the Clean Environment Act. This includes all new central generating facilities as well as major changes to existing facilities. The EIA process provides an opportunity for a thorough analysis of the major impacts, including short term, long term, social and economic. It is during the EIA that the sustainability of an undertaking can be determined.

Once approval has been gained under the EIA process to proceed with a new or modified facility, it must comply with the Air Quality and Water Quality Regulations of the Clean Environment Act. Emissions are monitored and are not to exceed the levels approved by the Minister of the Environment. Under the Act the Minister may change the approved levels of emissions to reflect new knowledge about pollutants and their effect on the environment. The only major energy program which would not be required to comply with the EIA regulations nor the Clean Environment Act is the non-consumption of energy through increased end use efficiency.

An EIA was recently completed for the multi-fuelled thermal generating station at Belledune. In addition to the usual environmental concerns (air, water, etc.), the EIA considered the effects of demand management, harbour dredging, the fishing industry, disposal of construction wastes, and the deposition of acidic compounds.

In 1984 the Federal and Provincial governments created an Environmental Assessment Panel to review a proposal to construct a second nuclear reactor at Point Lepreau. The panel made 39 recommendations and concluded that "the project can proceed without significant adverse effects provided certain recommendations are

followed". This EIA did not cover a CANDU-3 reactor, the type proposed for Lepreau II. The environmental implications of the new design would have to be assessed.

Environmental reviews are also carried out on non-generating energy projects, the most recent one being transmission lines. NB Power is proceeding with an EIA of a large scale electrical transmission line that will carry New Brunswick power to New England. This will be the first EIA of its kind in the Province and will look at such things as health risks of electromagnetic fields, damage to water, vegetation and wildlife and possible effects on heritage sites, forestry and tourism.

6.3 Atmospheric Emissions

Atmospheric emissions are by far the most significant energy-related threat to the environment that governments will have to deal with. Air quality recently received attention at the 30th Annual Premiers' Conference in Quebec City where they announced support for the Federal government to implement stricter vehicle emission standards. Recent studies provide considerable information on the increases in emissions from now to the year 2005. The major emissions of concern include sulphur dioxide, nitrogen oxides and carbon dioxide. Using 1985-1988 as the base years, unless action is taken to implement controls, sulphur dioxide emissions will increase by some 80%, and nitrogen oxides and carbon dioxide by about 100% within the next 10-15 years. Sulphur dioxide and nitrogen oxides are contributors to the problem of acid rain. Nitrogen oxides also contribute to the formation of ground level ozone. Carbon dioxide is one of the greenhouse gases and contributes to the problem of global warming.

Sulphur Dioxide (SO_2)

SO_2 has been the pollutant most focused on since 1980 in discussions within Canada and between Canada and the United States concerning acid rain. In 1985, Canada decided to reduce these emissions in eastern Canada by 50%. New Brunswick agreed to assist by implementing a 14% reduction of 1980 levels by 1994. While other source sectors have made a considerable contribution to this reduction through energy conservation and fuel switching programs, NB Power is faced with major capital expenditures to add controls to existing or new generating stations.

NB Power has proposed a plan that will allow it to limit emissions to 130,000

tonnes by 1994, some 70% of the allowable Provincial total. When these controls are implemented and effective, provincial SO_2 emission growth from 1985 to 1994 will be limited to 23%. It is anticipated that Provincial SO_2 emission will be capped at a maximum of 185,000 tonnes beyond 1994.

Nitrogen Oxides (NO_x)

Reports completed by Environment Canada, as part of a study on NO_x and volatile organic compound (VOC) controls, indicate that emissions of NO_x from diesel engines will almost double while those from NB Power will be five times 1985 levels by 2005. Continued growth of fossil-fired thermal generating capacity in the Province is the major contributor to growth of emissions of this pollutant. While some control technologies are available and feasible for new and existing sources, the more effective controls are relatively costly. Canada has signed an international agreement to develop a plan to freeze NO_x emissions at 1987 levels. The plan will be developed for Canadian Environment Ministers by 1990.

Carbon Dioxide (CO_2)

CO_2 emissions are believed to be contributing about one-half of the so-called "greenhouse effect" and since Canada is one of the largest users of energy per unit of output (GNP) in the world, all provinces will be expected to do their part to help reduce emissions. In 1986, Canada was the fourth largest source of carbon dioxide emissions on a per capita basis behind the German Democratic Republic (GDR), U.S.A. and Czechoslovakia.

The 1988 Toronto Conference on " The Changing Atmosphere: Implications For Global Security", sponsored by Canada, issued a Conference statement that called for the establishment of energy policies to reduce the emissions of CO_2 and other trace gases in order to reduce the risks of future global warming. Stabilizing the atmospheric concentrations of CO_2 is an imperative goal. The Conference also recommended as an initial global goal the reduction of CO_2 emissions by approximately 20 percent of 1988 levels by the year 2005. About one-half of this reduction would be sought from energy efficiency and other conservation measures. The other half should be effected by modifications in supplies.

Subsequent to this Conference Statement, Canadian Energy Ministers established a Federal-Provincial-Territorial Task Force on Energy and the Environment to review the Conference energy recommendations, particularly that of reducing CO_2 emissions by 20 percent of 1988 levels by 2005. The Task Force concluded that the 20 percent target was clearly ambitious. However, the Energy Ministers agreed that the consequences of inaction were unacceptable and agreed to pursue national and regional initiatives that would reduce greenhouse gas emissions and would be socially, economically and environmentally attractive to society. Initiatives include:

- increased conservation and energy efficiency measures;
- energy research and development;
- keeping options open to substitute other forms of energy for fossil fuels;
- examining CO_2 sinks, especially if they have an economic base, such as reforestation ; and
- setting an example in governments' own use of energy.

New Brunswick energy related CO_2 emissions were 19.46 million tonnes in 1988. A breakdown by sector is given in Figure 15. Clearly the industrial sector (36%) and electricity generation (34%) are the predominant sources.

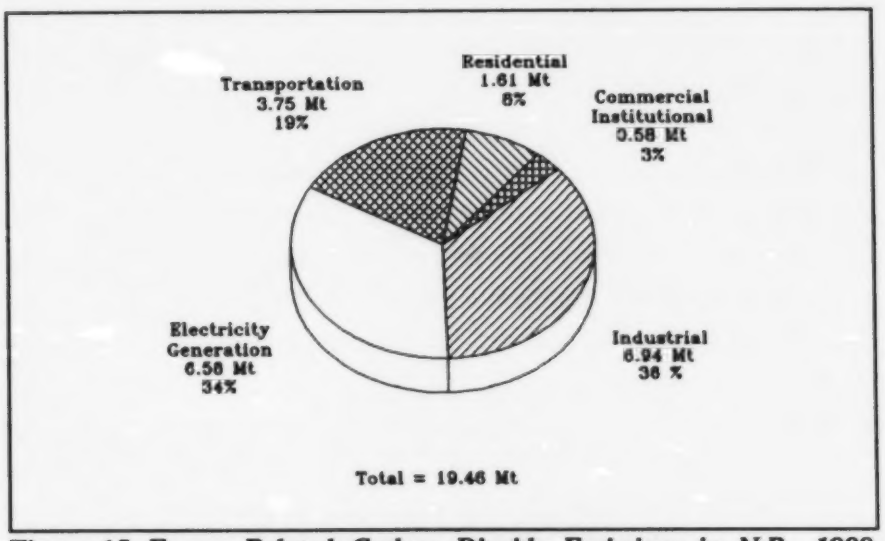

Figure 15 ***Energy Related Carbon Dioxide Emissions in N.B., 1988. Sources: Stats. Can. Cat.#57-202. A.P. Jacques, Environment Canada, National Inventory of Sources and Emissions of CO_2, June 1989.***

Consideration of power generating capacity requirements of approximately 1200 MW by the late 1990's could add an additional 9 million tonnes of CO_2 before the year 2005. Applying the target of 20 percent reduction of 1988 levels by the year 2005 would require New Brunswick to reduce projected emissions by at least 45 percent. This is similar to the 46 percent reduction level contained in the Federal-Provincial-Territorial Task Force report for Canada. In New Brunswick's case, however, the projection only includes electricity generation and not energy related emissions from other sectors which would increase it beyond the 9 million tonne total.

The Province is completing projections of CO_2 emissions through to the year 2005 and examining abatement measures. Clearly there is concern for New Brunswick's future energy initiatives as it attempts to limit CO_2 emissions. Available fuel choices and consumption patterns will create great difficulty for the province to meet the suggested 20 percent target level. A comparison of CO_2 emissions by fuel type is outlined in Table IV.

6.4 Initiatives to Reduce Emissions

There are a number of initiatives available to help reduce energy-related atmospheric emissions, some of which are as follows:

- Emission Controls - controls are available to reduce the emissions of SO_2 and NO_x but are costly, energy consuming and produce waste by-products which will require safe disposal.
- End-Use Reductions - many recommendations in the CO_2 report to the energy ministers and in other studies indicate that energy efficiency and conservation measures can reduce the energy growth trend with net economic and environmental benefits to the country. This is in sharp contrast to option 1 and can be accomplished without major changes to the Canadian lifestyle.
- Fuel Substitution - Coal and fuel oil are the largest contributors to the emissions under discussion. Natural gas and fuel wood, consumed efficiently, could reduce these emissions if substitution took place. Much more substantial reductions are available through the use of nuclear power.
- Transportation Efficiency - The transportation sector contributes substantially to growth in nitrogen and carbon dioxide emissions. It would

be desirable if more efficient personal and freight transportation systems were developed in Canada.

Table IV
CO_2 Emissions by Fuel Type

Fuel Type	CO_2 Emissions[5] (Tonnes/Terajoule)
Nuclear and Hydro	0.0
Natural Gas	49.7
Propane - Transportation	59.8
LPG's	59.8
Refined Petroleum Products	
Motor Gasoline	68.0
Diesel	70.7
Light Fuel Oil	73.1
Heavy Fuel Oil	74.0
Coals	
Anthracite	93.1
Bituminous Canadian	92.1
Bituminous Imported	88.9
Sub Bituminous	99.0
Lignite	108.4
Wood	
Residential	81.5
Industry	100.0
Coke & Coke Over Gas	86.0

[5] Source: Energy Mines and Resources Canada

7.0 Transportation

Transportation impacts considerably on the energy sector in that petroleum based fuels are required for motor vehicles and other industrial uses. In 1988 the transportation sector accounted for 24% of the total energy consumed in New Brunswick. The geography and human settlement patterns, coupled with an uncertain rail situation, are such that the motor vehicle will continue to be a key part of everyday life in the Province. In addition to the use of automobiles for personal reasons, the movement of goods and services by commercial vehicles will continue to follow the present trend.

Energy consumption by end-use or mode of transportation is illustrated in Figure 16. Transportation by road represents 82% of New Brunswick's energy consumption in the transportation sector and reflects the amount of pressure on the province's highways. The possible future elimination of rail would mean further pressures on our already over extended highway system. The TransCanada Highway is the main transportation corridor in the Province and the absence of federal assistance to rebuild it will impede the Province's efforts to reduce energy consumption and atmospheric emissions.

It is recognized that the private sector is a key player in the transportation field in that it is the oil refiner and distributor of refined petroleum products in the Province. Government must cooperate with the private sector to ensure that an adequate supply of petroleum products is available at a reasonable price for transportation purposes. It is also recognized that vehicle users can make a significant contribution to energy efficiency in New Brunswick. Examples to improve vehicular user efficiency include:

- Car pool or use public transportation whenever possible;
- Minimize use of the car's air-conditioner. It consumes several litres of gasoline for each tank of fuel burnt;
- Avoid short trips, instead, walk or ride a bicycle. A car burns more than twice as much gasoline during the first few minutes of operation than it does at other times;
- Inflate the tires properly. Underinflated tires cause drag, which can raise fuel consumption by as much as 6%;
- Use radial tires. They can improve fuel economy by about 0.3 Km per litre;
- When you buy a new car, choose a fuel efficient model;

- Keep the car tuned properly;
- Have the emissions system inspected regularly;
- Replace the air filter at least every 25,000 Km;
- Drive at a steady speed;
- Slow down whenever traffic permits. Less gasoline is burnt at 90 Km./hour than at 100 Km./hour;
- Avoid idling; 30 seconds of idling can consume more gasoline than the amount used to start the car.

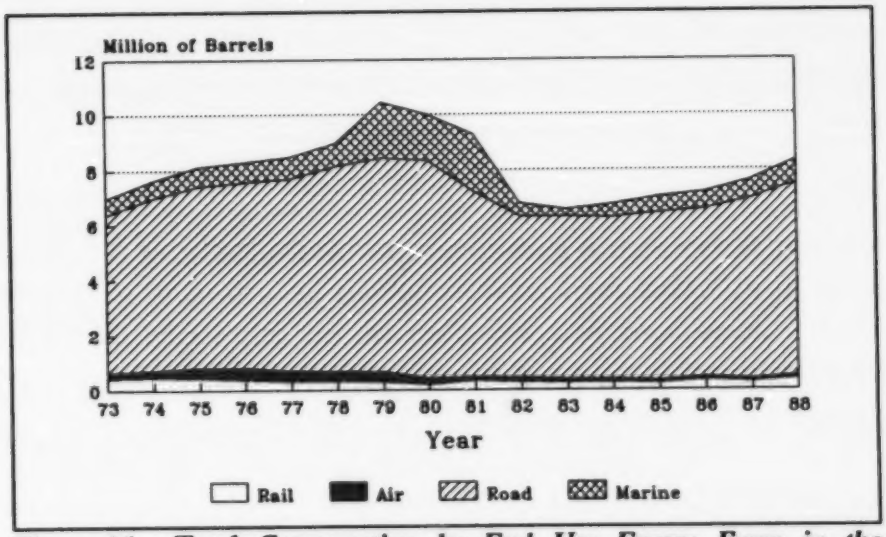

Figure 16 ***Total Consumption by End Use Energy Form in the Transportation Sector, 1973-88. Source: Stats. Can., Cat. #57-003, N.B. Energy Review.***

Transportation is one of the major sources of CO_2 emissions (19% in 1988 in New Brunswick) and, as noted in previous sections of this document, New Brunswick will join its federal and provincial partners in efforts to reduce it. This includes such initiatives as those recently announced at the 30th Annual Premiers' Conference. These involve a move towards parity with California vehicle emission standards and the adoption of a lower summer volatility in gasoline to achieve lower smog levels.

Fuel efficiency in new cars and trucks is a Federal jurisdiction, therefore, the provinces can play an advocacy role in lobbying the Federal government to improve fuel efficiencies. At the same time the Province can set an example in its own provincial

motor vehicle fleet and encourage municipal governments to do the same. Similarly, the Province can promote fuel efficiencies through driver education programs. An example of such a program was "ProTrucker". This program was developed by the Federal government in cooperation with the provinces, with the objective of significantly reducing fuel consumption in the trucking industry. A similar program called "ProFisher" was directed at the fishing industry to improve fuel efficiency in this sector. This program continues today with delivery by the New Brunswick School of Fisheries.

8.0 Research and Development

New Brunswick energy initiatives should consider a commitment to the advancement of new technologies in energy efficiency and new energy sources, both imported and indigenous, with the purpose of improving their economic and environmental viability.

A strong commitment to research and development to bring these energy sources forward is of utmost importance. Some of the options include indigenous fuels such as oil shales, coal and biomass, and imported fuels such as coal and liquid hydrocarbons. Nuclear energy continues to be a viable option in New Brunswick, recognizing its potential as a significant contributor to the energy supply mix. Energy efficiency also is as much a part of the total supply as is the location and development of additional indigenous reserves.

If Lepreau II were to proceed, it would create a major research and development opportunity for New Brunswick universities and other institutions. The possibilities in the fields of science, engineering and the environment are considerable. The Government would include a research package as part of its deliberations with Atomic Energy of Canada.

Research and development into cleaner coal technologies, including Integrated Gasification Combined Cycle (IGCC) technology for electricity generation, should be pursued to reduce atmospheric emissions per unit of electrical energy output. Such cleaner coal technology should enable New Brunswick to continue to use indigenous coal resources for power generation once such coal has been evaluated against the technology.

Many of New Brunswick's future energy options require more advanced technologies in order to become more economically and environmentally viable. Moreover, for effective utilization of new technologies, the relationship among research centres, industries, and federal and provincial governments must be coordinated and collaborative. Commercialization is an integral part of research and development and an important responsibility of government is to disseminate technological developments, especially throughout decentralized industries such as the building construction sector.

Efforts should be made to encourage energy suppliers, developers and energy users to participate with government in energy R&D and commercialization through various industrial and economic development programs. In addition, a strong Federal role in energy R & D is essential as much of the work is beyond the scope of Provincial financial capability. The Province will continue to seek support from the Federal government for energy R & D and encourage cooperation in areas of mutual concern. A close liaison should be maintained with the Federal government and with the other provinces to achieve an effective coordination of efforts in energy R & D.

Glossary

Terms

Energy — The ability to do work; the ability to cause change or the potential to cause change.

Joule — The basic unit of energy in the metric system. One kilowatt-hour (kWh) is equivalent to exactly 3,600 Joules. One British Thermal Unit (BTU) is equivalent to approximately 1,055 Joules.

Power — The rate at which energy is delivered or the potential to be delivered.

Watt — The basic unit of power in the metric system. One watt is the work done at the rate of one Joule per second.

Metric Prefixes

kilo (k)	1000
mega (M)	1,000,000
giga (G)	1,000,000,000
tera (T)	1,000,000,000,000

Equivalents

Terajoule — 10^{12} Joules is the energy contained in 165 barrels of crude oil. This is approximately the energy consumed annually by 10 typical households.

Kilowatt-hour (kWh) — A unit of energy equal to the work done by one kilowatt acting for one hour. The most commonly used unit of electrical energy.

Megawatt (MW) — The unit of power equal to 1,000 kilowatts; used to measure the rate of output of electric power plants (eg. 653 MW Mactaquac Hydro Plant).